7.2 Fission and Fusion

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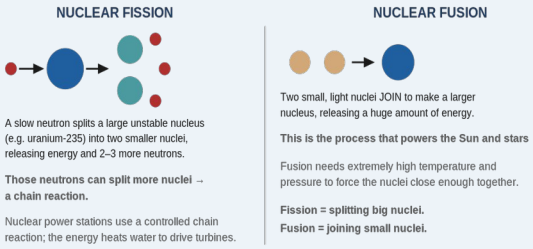
1. KEY VOCABULARY

TERM	MEANING
Nuclear fission	Splitting a large unstable nucleus into smaller ones.
Nuclear fusion	Joining small light nuclei into a larger nucleus.
Chain reaction	Neutrons from one fission triggering further fissions.
Control rod	Absorbs neutrons to control the rate of fission.
Moderator	Slows neutrons down so they can cause fission.

2. FISSION & FUSION



3. NUCLEAR FISSION

A slow-moving neutron is absorbed by a large unstable nucleus (e.g. uranium-235), which splits into two smaller nuclei.
This releases energy and 2–3 more neutrons, which can split more nuclei — a chain reaction.

4. NUCLEAR FUSION

Two small, light nuclei join to form a larger nucleus, releasing a very large amount of energy.
Fusion powers the Sun and all stars. It needs extremely high temperature and pressure.

5. CONTROLLING A REACTOR

Control rods absorb neutrons — lowering them slows the reaction, raising them speeds it up.
A moderator slows the neutrons so they are more likely to cause fission. The energy released heats water to drive turbines.

6. THE WHY

Why a chain reaction must be controlled: if every fission triggered several more, the reaction would run away — control rods keep it steady.
Why fusion is hard to use on Earth: the nuclei repel each other, so enormous temperatures and pressures are needed to force them together.

7. COMMON EXAM MISTAKES

✗ Mixing up fission and fusion.
✓ Fission = splitting big nuclei. Fusion = joining small nuclei.
✗ "The Sun is powered by nuclear fission."
✓ The Sun is powered by nuclear FUSION.
✗ "Control rods slow the neutrons down."
✓ Control rods ABSORB neutrons; the moderator slows them.

8. SELF-CHECK · cover & quiz

Can you…

1. Describe the process of nuclear fission?
2. Explain what a chain reaction is?
3. Describe the process of nuclear fusion?
4. State the jobs of control rods and the moderator?
5. Explain the difference between fission and fusion?
6. Explain why fusion is difficult to achieve on Earth?